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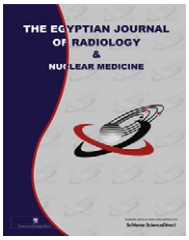

ORIGINAL ARTICLE

Role of transperineal sonography in diagnosis of placenta previa/accreta: A prospective study

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KEYWORDS

Transperineal ultrasound;
Placenta previa;
Placenta accreta

Abstract *Purpose:* To evaluate the role of transperineal ultrasound (TPS) in the detection of morphological and vascular manifestations of placenta previa (PP)/accreta and to compare it with transabdominal sonography (TAS) and transvaginal sonography (TVS), with the clinical outcomes as the reference standards.
Materials and methods: TPS, TVS, and TAS were carried on 134 patients after 28 weeks' gestation presented with antepartum hemorrhage. The final diagnosis was obtained from the obstetrician at time of delivery and from histopathological reports.
Results: One hundred and three patients had PP, the sensitivity, specificity, and accuracy in diagnosing PP were 97.1%, 75% and 94% for TPS, 94.2%, 75% and 91.5% for TAS, and 98.1%, 93.8% and 97.4% for TVS respectively. PP accreta was present in 39 patients. The sensitivity, specificity, and accuracy in diagnosing PP accreta were 89.7%, 100% and 96% for TPS, 87%, 95% and 92.2% for TAS, and 94.9%, 100% and 98% for TVS respectively.
Conclusion: TPS is a valuable approach for evaluating patients with high risk of PP & PP accreta, it is a safe, rapid, & accurate technique with little patient discomfort.
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1. Introduction

PP is the most common diagnosable cause of antepartum hemorrhage, its incidence ranges from 2% to 6.3% depending upon maternal age. Although previous curettage and abortion are risk factors, patients with no previous surgery still have the risk of PP (1–3).

Placenta accreta occurs when the chorionic villi abnormally invade the myometrium. Based on histopathology it is divided into three grades: placenta accreta (the chorionic villi are in contact with the myometrium), placenta increta (the chorionic villi invade the myometrium), and placenta percreta where the

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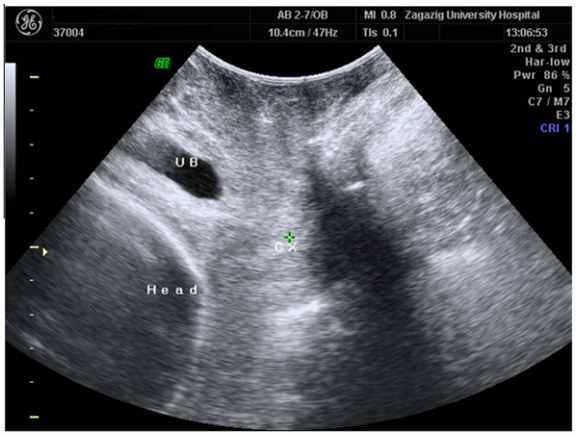

Fig. 1 Normal anatomy by transperineal approach, the cervix is horizontally oriented, UB: urinary bladder, CX: cervix. No placental tissue interposed between the presenting part (head) and the cervix (cx).

chorionic villi penetrate the uterine serosa. With increasing rate of cesarean delivery, the incidence of both placenta previa and placenta accreta (a collective term for accreta, increta and percreta) is steadily increasing in frequency. The incidence of placenta accreta has increased from approximately 1/30,000 deliveries to 1/533 deliveries. The risk of placenta accreta in patients with placenta previa is nearly 10% (4–7).

Placenta accreta unexpectedly encountered can lead to catastrophic blood loss. It has become the leading cause of emergency hysterectomy. Accurate preoperative diagnosis of placenta accreta plays a crucial role in the management of these complications. Antenatal sonography is used to help the diagnosis and direct clinical management leading probably to favorable outcomes. The antenatal detection rate of placenta accreta on ultrasound ranges from 33% to 100% (8–13).

In patients with PP digital vaginal examination is contraindicated because of the risk of provoking life-threatening hemorrhage. In the anterior wall placenta transabdominal ultrasound with a mildly filled maternal bladder might be a suitable approach to identify the lower uterine segment. However, in the posterior wall placenta transvaginal ultrasound is preferred (14–16).

Studies have demonstrated that while transvaginal sonography is almost accurate in diagnosis and localization of PP, transabdominal sonography is associated with incorrect diagnosis in about 25% of the cases. Factors affecting the accuracy of TAS are poor visualization of the posterior placenta, the fetal head that can interfere with the visualization of the lower segment, obesity and improper filling of the maternal bladder (17).

Because of safety concerns that prohibit vaginal manipulation in patients with placenta previa transvaginal sonography

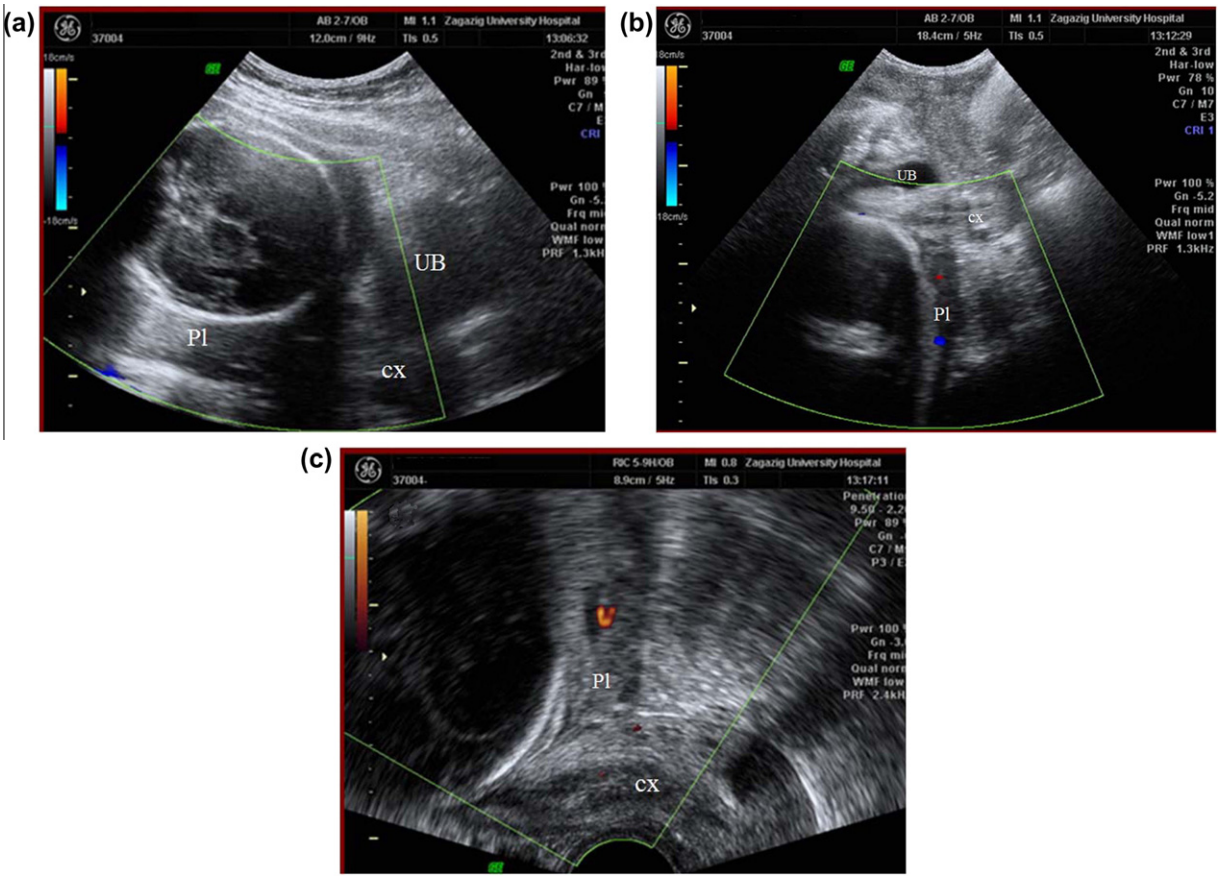

Fig. 2 Sonograms of placenta previa minor posterior. Transabdominal (a), transperineal (b) and transvaginal ultrasound (c),UB: urinary bladder, CX: cervix, Pl: placenta; showing the lower margin of the placenta (pl) reaching the cervix (cx) without encroaching on the internal os. In TPS the cervix is horizontally oriented and the placenta is vertically oriented.

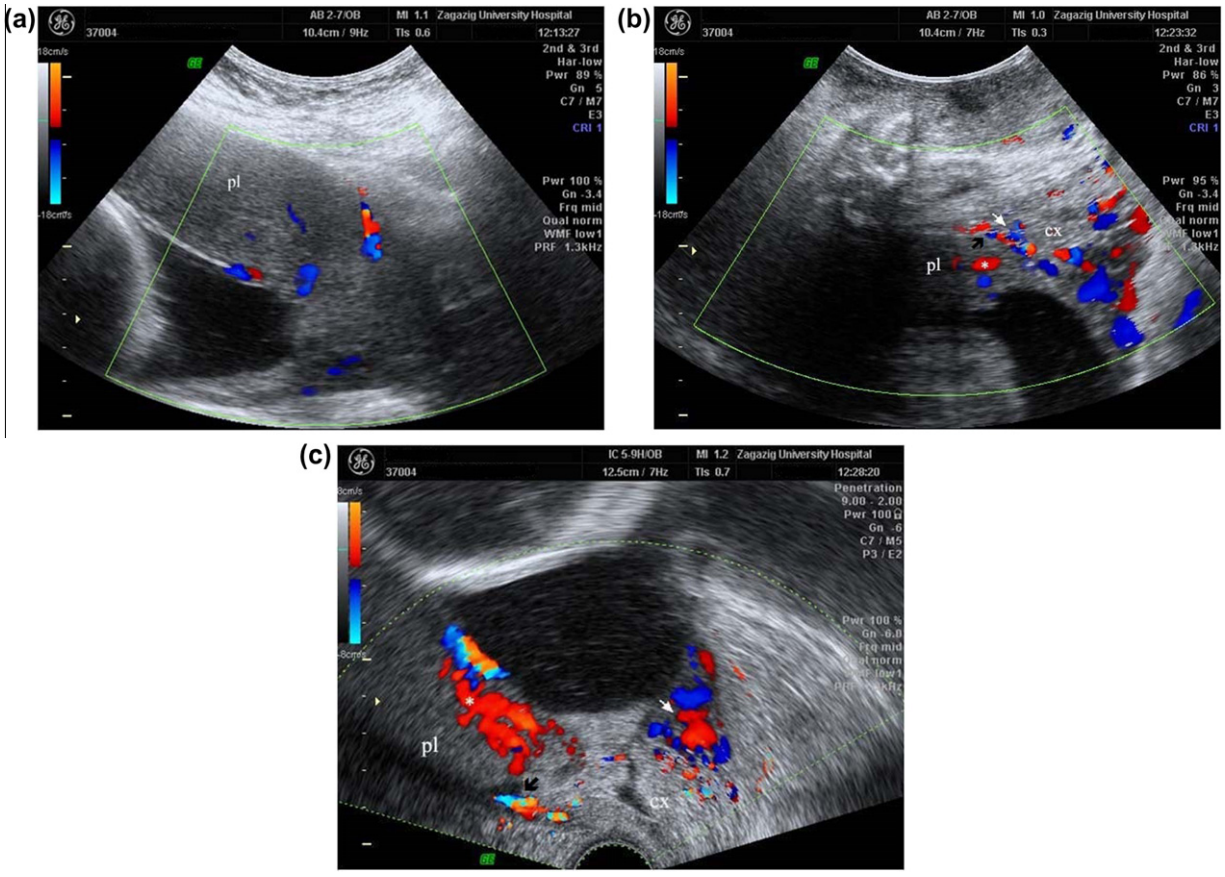

Fig. 3 Sonograms of placenta previa centralis with focal accreta. Transabdominal (a), transperineal (b) and transvaginal ultrasound (c), CX: cervix, Pl: placenta; showing placental lacuna (*) with increased cervical vasculature (white arrow), and subplacental vasculature with focal loss of subplacental sonolucent line (black arrow).

remains underutilized. Transperineal sonography evolved as an alternative imaging modality allowing cervical visualization during the third trimester of pregnancy in most patients in whom transabdominal sonography of this area is unsuccessful. It provides a more convenient means of imaging the cervix and lower uterus without requiring vaginal penetration, or external fetal manipulation (18–20).

The goal of this study was to evaluate the role of transperineal ultrasound (TPS) in the detection of morphological and vascular manifestations of placenta previa/accreta and to compare it with transabdominal sonography (TAS) and transvaginal sonography (TVS), with the clinical outcomes as the reference standard.

2. Patients and methods

This prospective study was conducted at Zagazig university hospitals, between March 2010 and April 2012. A total of 134 patients, pregnant after 28 weeks' gestation presented with antepartum hemorrhage and preliminary ultrasound examinations suggestive of placenta previa (PP), were included. Institutional review board approval and informed consent were taken for all patients. Fifteen patients were missed during follow up and/or labor, so they have been excluded from the analysis. The remaining 119 patients were subjected to complete history taking, full general and abdominal examination. TAS, TVS and TPS were done for the patients using Voluson 730 Pro V machine (GE Healthcare, Austria) with a 3.5 MHz sector transducer for TAS and TPS, and 7.5 MHz transvaginal transducer for TVS.

2.1. Transabdominal scanning

The examination was performed while the mother in the supine position with her urinary bladder partially filled so as not to distort the configuration of the cervix or lower uterine segment. The gestational age was determined by measurement of the biparietal diameter (BPD) and femur length (FL). Sonographic evaluation of placenta previa requires visualization of both the cervix and the lower edge of the placenta.

2.2. Transvaginal scanning

The patient was examined in the supine position with empty urinary bladder. The transducer was inserted cautiously into the vagina, up to a short distance from the cervix under continuous observation of the image. No contact was made with the cervix. A sagital scan of the whole length of the cervix and lower part of the uterus was obtained first in each patient. If the lower placental edge was not visualized in this plane, the transducer was then rotated 90° in each direction to visualize any presence of placental tissue in the four quadrants of the lower

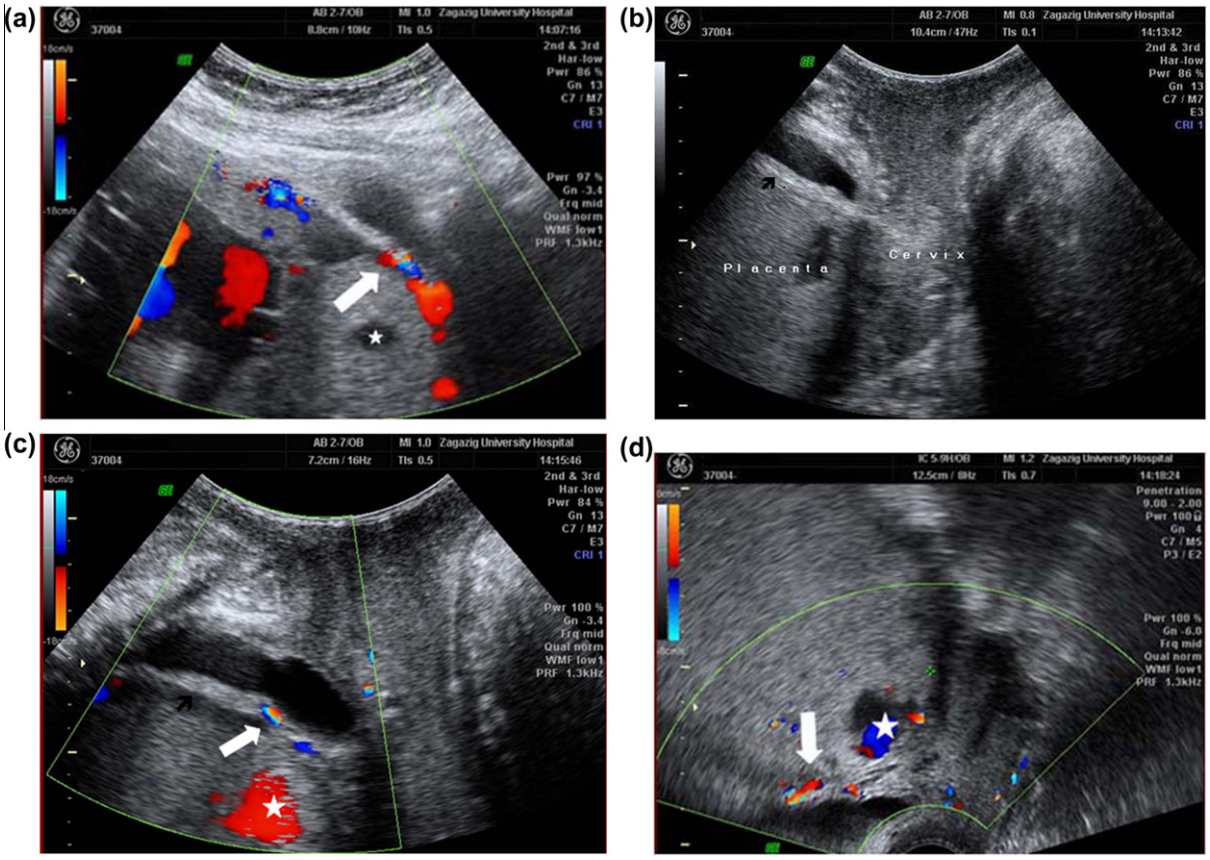

Fig. 4 Sonograms of placenta previa centralis accreta. Transabdominal (a), transperineal (b,c) and transvaginal ultrasound (d), showing placental lacuna (*), loss of subplacental sonolucent line (black arrow), blood vessels are seen crossing the placenta into the myometrium (white arrow).

uterine cavity. During rotation, adjustment of the transducer was necessary to keep the internal cervical os continuously visualized.

2.3. Transperineal scanning

Ultrasound gel was placed on the head of the same abdominal transducer. A protective covering was applied to the transducer head, secured with a rubber band and an ultrasound gel was applied to the other surface of the protective covering. The examination was carried out while the patient lied supine with her urinary bladder empty, and the thighs abducted sufficiently to allow placement and lateral angulation of the transducer. The transducer was placed directly over the perineum in a sagittal orientation between the labia majora, usually directly over the labia minora, but occasionally between them. The center of the transducer was located posterior to the urethra and anterior to the vagina. When the cervix and lower uterine segment were visualized, the transducer was slowly angled medially and laterally to image the entire internal surface of the cervix.

For all US examinations the placenta was localized and considered praevia if placental tissue was overlying any part of the cervix. Criteria for diagnosis of PP were: 1) complete previa—covers the internal os; 2) partial previa—partially covering; or marginal—placental edge going to the internal os.

PP was excluded if at least one of the following was present: 1) The lower edge of the placenta seen separate from the cervix; 2) Amniotic fluid between the presenting part and the cervix without interposed placental tissue; 3) The presenting part immediately overlying the cervix without intervening placental tissue.

TAS was considered inadequate to exclude PP if the inferior edge of the placenta could not be imaged or the cervix could not be visualized.

For diagnosis of placenta accreta Gray-scale B-mode sonography was first used to screen the placental tissue in a systematic fashion. Careful attention was paid to homogeneity and echogenicity patterns of the placenta. Doppler was not performed if on gray-scale imaging there was clear demarcation of the placenta from the uterine wall.

The US findings for accreta based on Wong et al. (21) have been described as: 1) Loss of the subplacental sonolucent space at the site of accreta, 2) Thinning of the myometrium < 1 mm, 3) With placenta percreta, there will be focal disruption of the uterine serosa, extension of tissue outside the uterus, and loss of the bladder wall echogenic mucosal reflector.

Further assessment of the placenta was performed using superimposed color and spectral Doppler flow.

The color Doppler criteria suggestive of placenta previa accreta that we assessed according to Chou et al. (4) included the following:

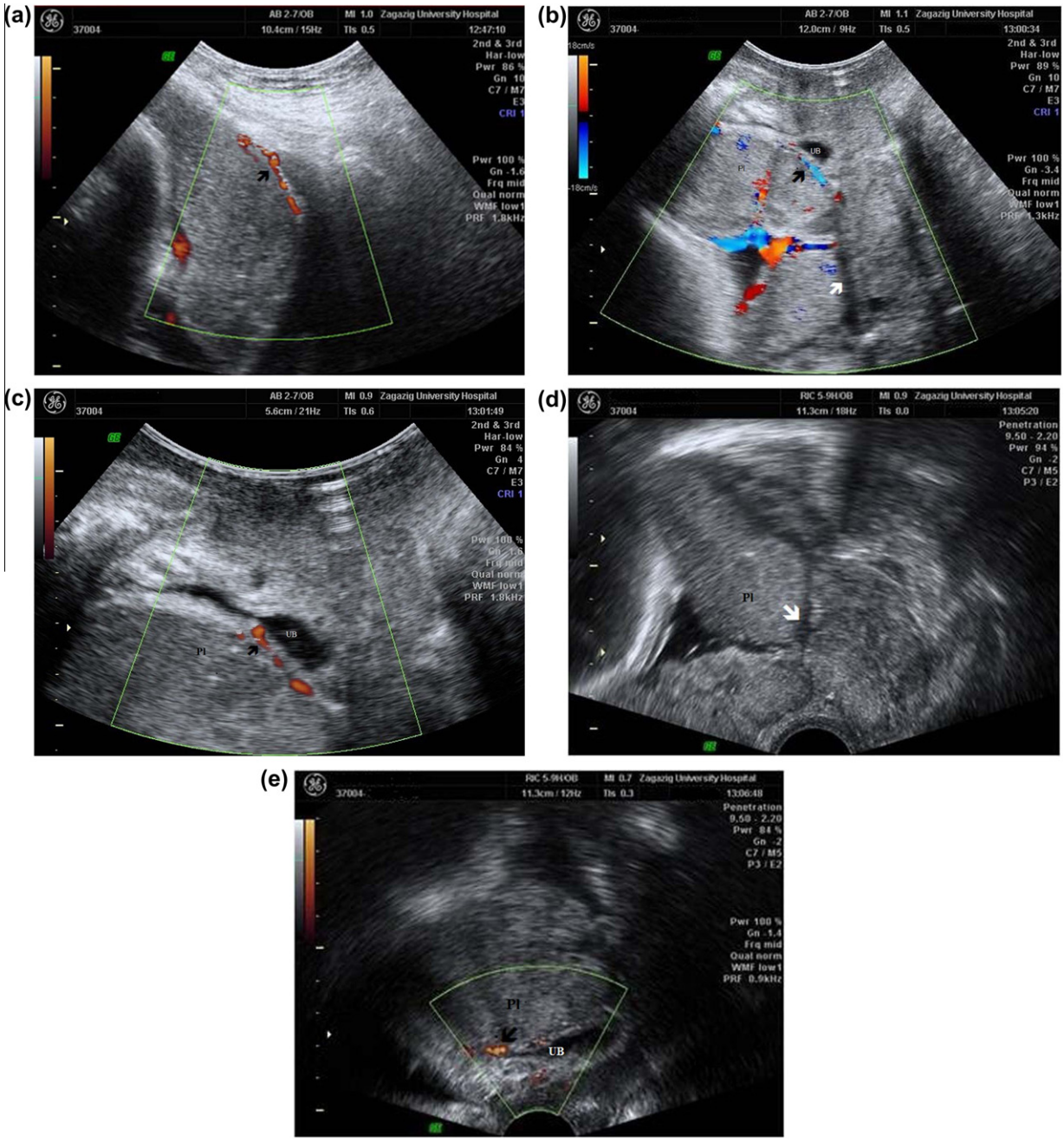

Fig. 5 Sonograms of placenta previa centralis with focal accreta. Transabdominal (a), transperineal (b,c) and transvaginal ultrasound (d,e), UB: urinary bladder, Pl: placenta; showing subplacental sonolucent line(white arrow), with focal increased subplacental vasculature and loss of subplacental sonolucent line (black arrow).

1. A diffuse lacunar flow pattern exhibiting diffusely dilated vascular channels scattered throughout the whole placenta and the surrounding myometrial or cervical tissues.
2. A focal lacunar flow pattern showing irregular sonolucent vascular lakes distributed focally within the intraparenchymal placental area.
3. Interphase hypervascularity with abnormal blood vessels linking the placenta to the bladder.
4. Markedly dilated peripheral subplacental vascular channels.

The intraoperative data were obtained from the obstetrician at time of delivery and the histopathological data were obtained from histopathological reports. The statistical software package SPSS version 10.0 was used for data analysis. A probability value of < 0.05 was taken as statistically significant.

3. Results

One hundred nineteen patients were included in this study with mean age of 27 ± 4.6 years, and mean gestational age of

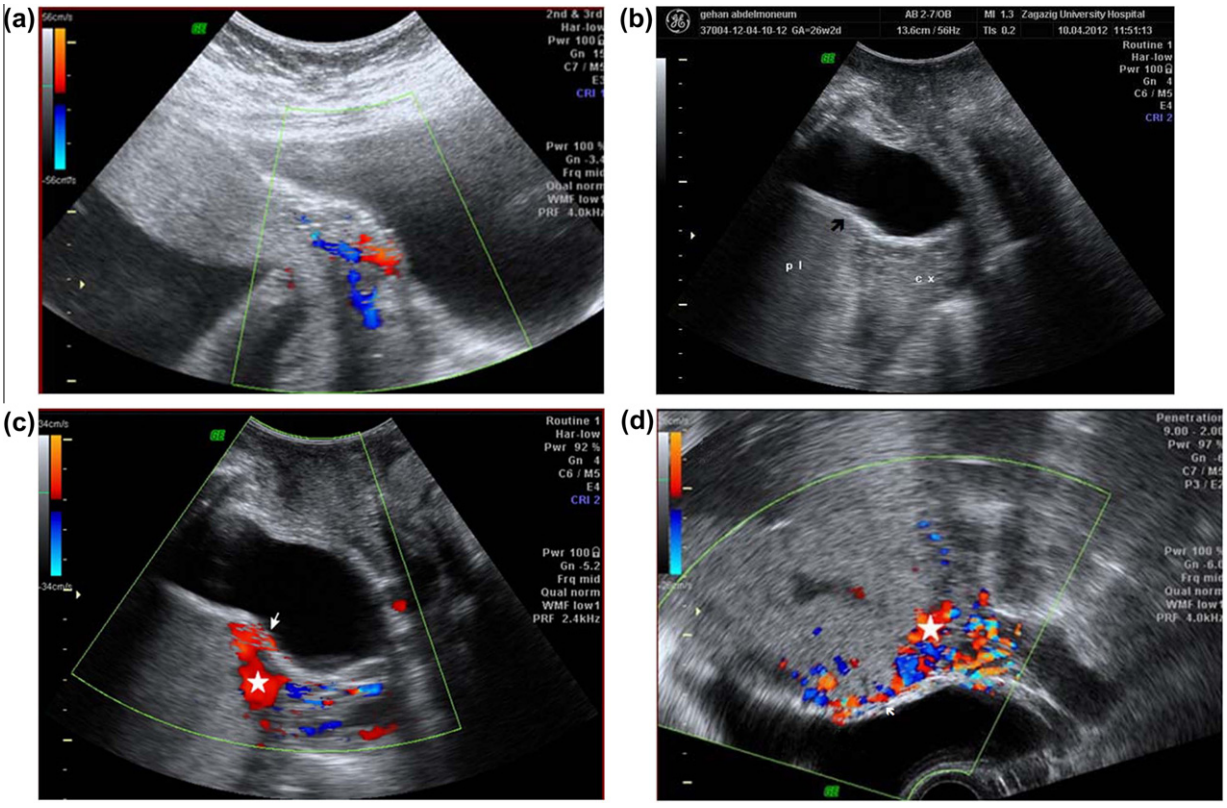

Fig. 6 Sonograms of placenta previa increta. Transabdominal (a), transperineal (b,c) and transvaginal ultrasound (d), CX: cervix, Pl: placenta; showing placental lacunae (*), loss of subplacental sonolucent zone (black arrow), with blood vessels at the uterus-urinary bladder interface but not reaching the UB lumen (white arrow).

36.0 ± 5.5 weeks. According to the delivery outcome 103 patients had placenta previa (41 patients had complete placenta previa, and 62 patients had partial placenta previa), while the remaining 16 patients had no placenta previa. Illustrative cases are presented in (fig. 1–7). TPS diagnosed PP in 104 patients, and was excluded in 15 patients. There were three false negative cases, and four false positive cases on TPS. TAS and TVS were suggestive of PP in 101 and 102 patients respectively, and excluded PP in 18 and 17patients respectively (Table 1)

There were 6 false negative cases, and 4 false positive cases on TAS, while on TVS there were two false negative cases, and one false positive case.

The sensitivity, specificity, and accuracy in diagnosing PP were 97.1%, 75% and 94% for TPS, 94.2%, 75% and 91.5% for TAS, and 98.1%, 93.8% and 97.4% for TVS, respectively (Table 2).

Among 103 patients positive for PP 39 patients were proved to have PP accreta based on delivery outcome. The clinical data of these patients are shown in (Table 3). Twelve of the 39 patients had history of cesarean sections, nine had history of dilatation and curettage, and eighteen patients had history of both operations.

PP accreta was correctly diagnosed in 35/39 patients by TPS and in 34 and 37 patients by TAS and TVS respectively (Table 4).

On grey scale TPS there was loss of the subplacental sonolucent space in all (35) cases with PP accreta, focal disruption of the uterine serosa with loss of the bladder wall echogenic mucosal reflector was seen in 17 patients with PP increta and in 7 patients with PP percreta.

On color Doppler TPS examination focal lacunar flow pattern within the intraparenchymal placental area was seen in 7 patients with PP accreta, 11 patients with PP increta and in 2 patients with PP percreta, diffuse lacunar flow pattern scattered throughout the whole placenta was seen in 4 patients with PP accreta, 8 patients with PP increta and in 5 patients with PP percreta, dilated peripheral subplacental vascular channels was seen in 4 patients with PP accreta, 3 patients with PP increta and in 4 patients with PP percreta, interphase hypervascularity with abnormal blood vessels linking the placenta to the bladder in 14 patients with PP increta and in 7 patients with PP percreta.

There were 4 cases of false negative PP accreta diagnosed by TPS, 5 cases by TAS, and 2 cases by TVS.

The sensitivity, specificity, and accuracy in diagnosing PP accreta were 89.7%, 100% and 96% for TPS, 87%, 95% and 92.2% for TAS, and 94.9%, 100% and 98% for TVS respectively (Table 5).

4. Discussion

Accurate diagnosis of pp is essential to avoid major obstetric complications. Ultrasound is the gold standard method of diagnosis. Lower segment placenta carries difficult diagnosis as it is crowded into a smaller space with more attenuation of sound waves (22).

Accuracy of placental localization has been studied exclusively in many studies. Rani et al. compared TPS & TAS for diagnosis of pp. There was six cases of false positive diagnosed

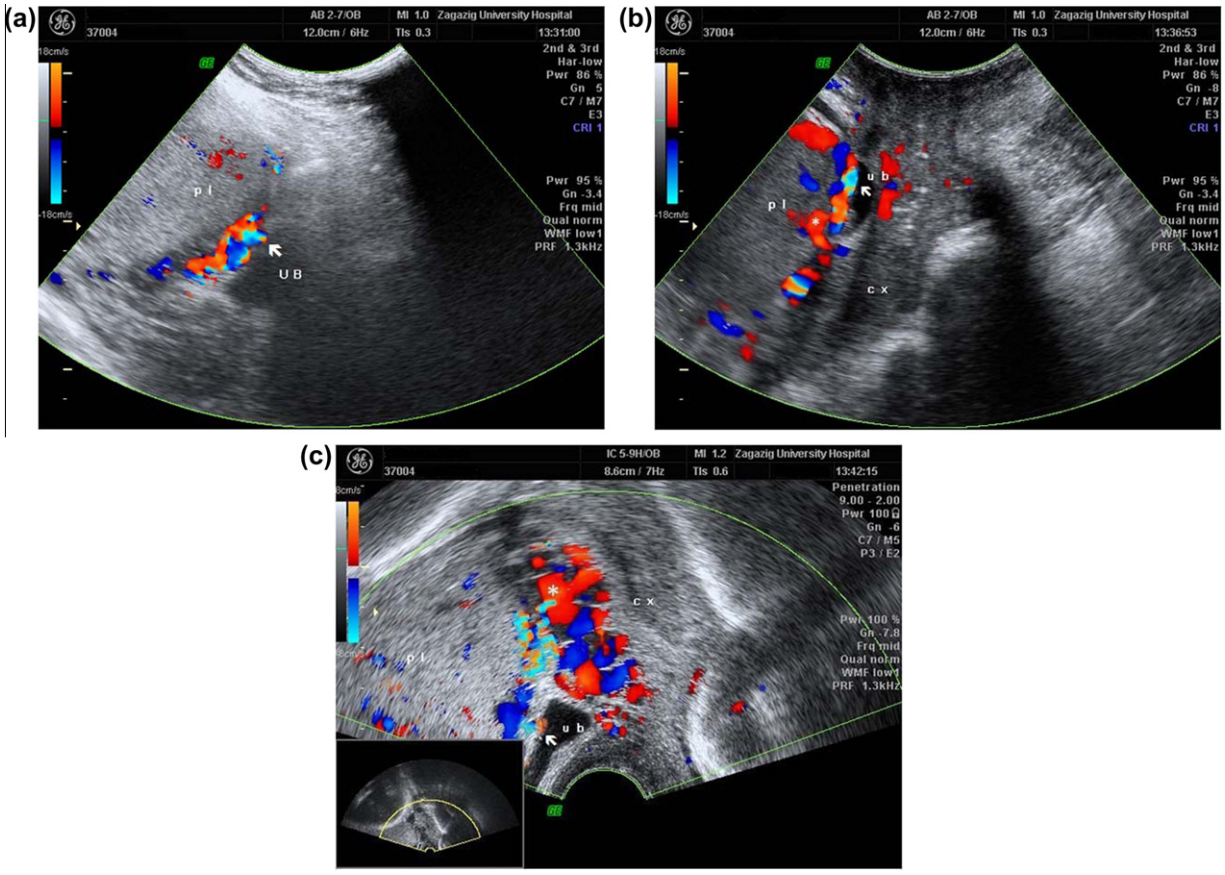

Fig. 7 Sonograms of placenta previa percreta. Transabdominal (a), transperineal (b) and transvaginal ultrasound (c), ub: urinary bladder, CX: cervix, Pl: placenta; showing placental and cervical lacunae (*), and crossing blood vessels to urinary bladder mucosa (arrow).

Table 1 Validity of TAS, TVS, and TPS in diagnosis of PP.

Type of placenta	TAS	TVS	TPS	Final diagnosis
Positive for PP				
Complete	57	60	61	62
Partial	44	42	43	41
Negative for PP	18	17	15	16
Total	119	119	119	119

Table 2 Comparison between TAS, TVS, and TPS in diagnosis of PP.

	TAS	TVS	TPS
Sensitivity (%)	94.2	98.1	97.1
Specificity (%)	75	93.8	75
Positive predictive value (%)	96	99	96.2
Negative predictive value (%)	66.7	88.2	80
Accuracy (%)	91.5	97.4	94
Kappa test	0.65	0.89	0.74
P value	0.0001	0.0001	0.0001

with TAS (69 out of 75), PPV 92% with TPS, one case of false positive, no false negative (100% sensitivity, 83.33 specificity, 98.57 PPV & 100% NPV) (23)

Adeyomoye et al. (24) compared TPS & TAS in the diagnosis of PP. The overall sensitivity, specificity, and accuracy of TPS were (99.2%, 100% &99.3%) for TAS (95.1, 99.9% &97.7%).

Mowafi et al. (14) in their study showed TPS to be superior to TAS in localization of placenta, with sensitivity, specificity, PPV, NPV & accuracy, 98.5%, 97.5%, 94.8%, 99.1% and 97.75 respectively.

Hertzberg et al. (20), Dawson et al. (25), Patel 2000 (26)& Xiao-qing et al. (27) studied the value of TPS in that combination of both approaches is superior to one of them alone in diagnosing placental location.

In agreement with previous studies, in our study TPS successfully diagnosed PP in 104 patients & excluded in 15 patients. There were three false negative cases & four false positive cases. The sensitivity, specificity & accuracy in diagnosing PP were 97.1%, 75% & 94% for TPS and 94.2%, 75%, & 91.5 for TAS.

Although TAS is usually successful in visualization of the cervix during the 2nd trimester of pregnancy, visualization becomes progressively more difficult during the 3rd trimester. To this end, techniques have been tried in the form of trying to elevate the fetal presenting part from the pelvis but this is uncomfortable to the patient & mostly unsuccessful (28).

A potential difficulty with TPS is the presence of rectal gas obscuring the region of the external os, but this did not consti-

Table 3 Clinical data of 39 patients with PP accreta.

Data		Number
1-Previous surgery	• Cesarean section (SC)	12 cases
	• D&C	9 cases
	• Both	18 cases
2- Neonatal birth weight		2141 ± 536 (mean ± SD)
3-Indication for delivery	• Antepartum hemorrhage	19 cases
	• Elective	20 cases

Table 4 Validity of TAS, TVS, and TPS in diagnosis of PP accreta.

Type of Placenta	TAS	TVS	TPS	Final diagnosis
PP accreta	9	11	14	12
PP increta	19	19	14	17
PP percreta	6	7	7	10
Total	34	37	35	39

Table 5 Comparison between TAS, TVS, and TPS in diagnosis of PP accreta.

	TAS	TVS	TPS
Sensitivity (%)	87	94.9	89.7
Specificity (%)	95	100	100
Positive predictive value (%)	92	100	100
Negative predictive value (%)	92.4	97	94.1
Accuracy (%)	92.2	98	96.1
Kappa test	0.83	0.95	0.91
P value	>0.0001	>0.0001	>0.0001

tute any problem with patient with PP because looking for placental tissue overlying the cervix necessitates visualization of the internal surface of the cervix. (19).

Another approach is to use TVS for diagnosing placental location. In our study TVS is used in comparison to TAS & TPS in diagnosing PP. TVS showed 98.1% sensitivity, 93.8% specificity, 99% PPV & 88.2 NPV & 97.4% accuracy.

With the first use of TVS in diagnosing PP by farine et al. (29),TVS correctly identified placenta previa in 29 of 34 patients compared to only 16 to 34 identified trans-abdominally.

In 1992, Sherman & Colleagues (30) in their study of TVS in diagnosing PP showed that TVS provided superior clarity of diagnosis.

Ghourab in 2001 (31),studied 128 Patients with TVS. All of them have either clinical suspicion or TAS diagnosis of PP. TVS excluded the diagnosis of PP in 34 out of 138 patients (24.6%), none of them had cesarean section due to bleeding. They concluded that lower placental edge shape seen on TVS may improve the predication of mode of delivery & the clinical outcome.

Discussion of PP would not be completed without diagnosis of abnormal placental adherence (Placenta accreta) which carries major risks up to maternal death (17).

Guy & associates in 1990 (32) first used TVS for prenatal diagnosis of PP accreta in 16 patients with PP.

In 2000, Chou & Co-workers (33) studied 80 patients with persistent placental previa underwent TAS (B-mode and color Doppler US), their study showed 82.4% sensitivity, 96.8% specificity , PPV 87.5% & NPV 95.3%.

In our study, TAS showed sensitivity, specificity, PPV, NPV, and accuracy of 87, 95%, 92%, 92.4%, and 92.2% respectively in diagnosing PP accreta with gray scale & color Doppler.

Yang et al. (34), studied the role of TVS finding of intraplacental lacunae in patients with placenta previa totalis with previous C.S. in the prediction of placenta accreta. They concluded that intraplacental lacunae can be useful in patients with PP to predict abnormal placental adherence.

To our knowledge, no previous studies compared the three approaches (TAS, TVS, and TPS) for the diagnosis of PP & to predict abnormal placental adhesions. In our study the sensitivity, specificity, PPV, NPV, and accuracy were 94.9%, 100%, 100%, 97%, 98% & 89.7%, 100%, 100%, 94.1%, 96% for TVS and TPS, respectively for predicting PP accreta.

With advanced gestation visualization of the cervix & lower edge of the placenta which are essential for diagnosing placenta previa, becomes more difficult by TAS. Both TPS & TVS are valuable techniques to complement TAS for the diagnosis of placenta previa & abnormal placental adhesions. However, TPS showed to have advantages over TVS because of less discomfort, no need for specialized equipment, and avoidance of vaginal penetration especially in cases where risk of infection is present e.g. PROM, or dilated external os.

In conclusion; being a safe, rapid, & accurate technique with little patient discomfort; TPS is a valuable approach for evaluating these high risk group of patients with PP & PP accreta.

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